DIE CASTING ENGINEER

DECEMBER, 1959

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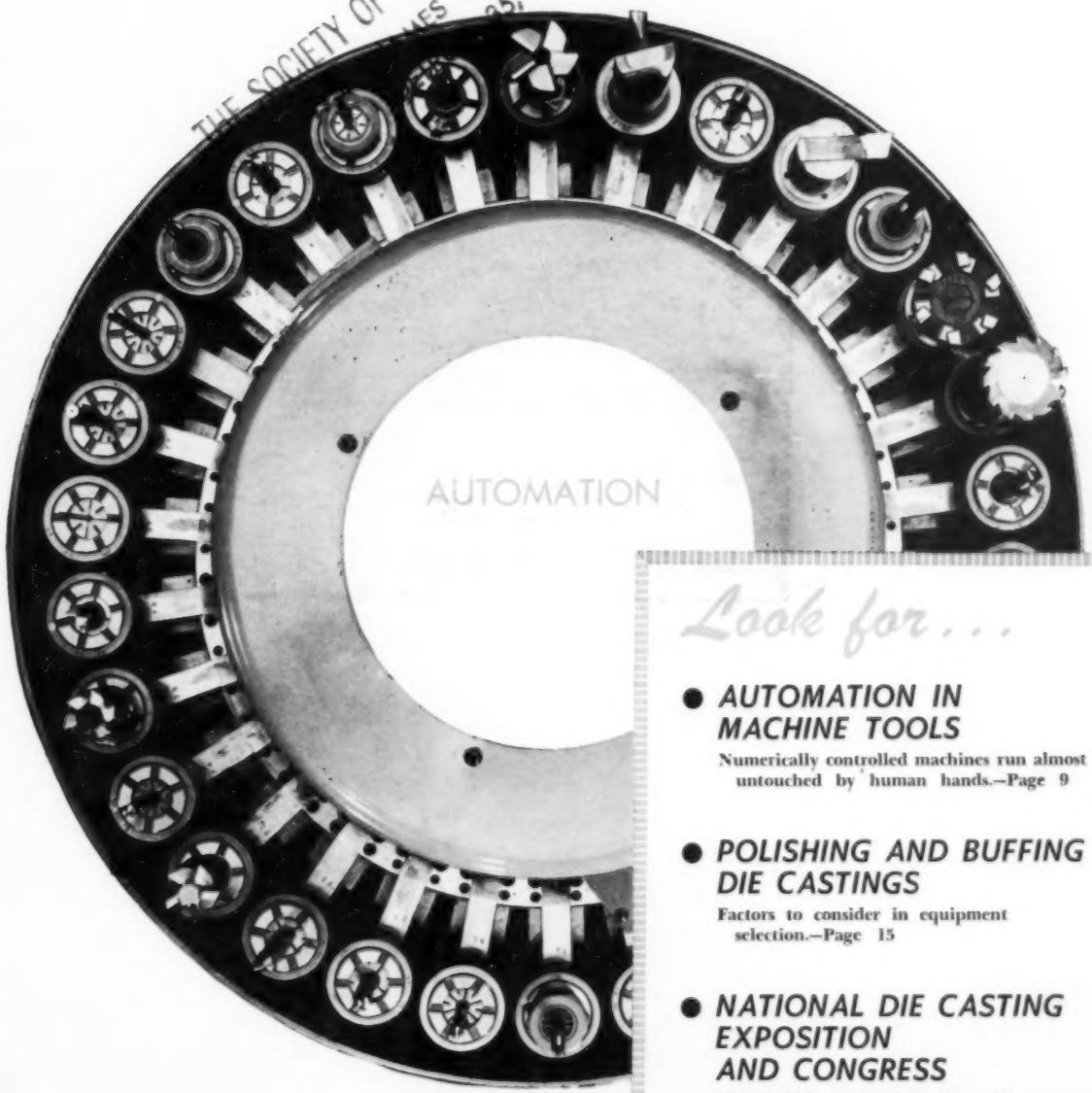

Look for . . .

- **AUTOMATION IN MACHINE TOOLS**
  Numerically controlled machines run almost untouched by human hands.—Page 9
- **POLISHING AND BUFFING DIE CASTINGS**
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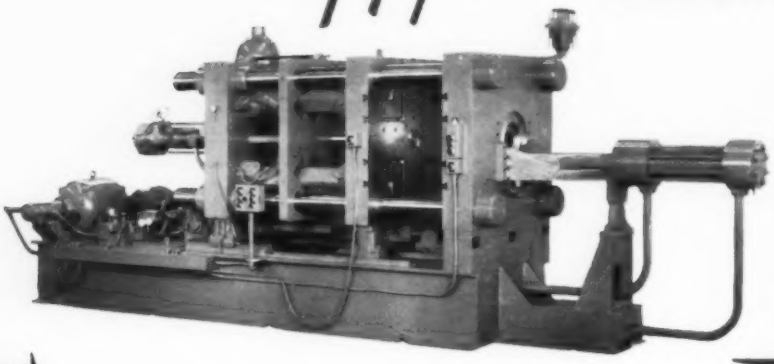
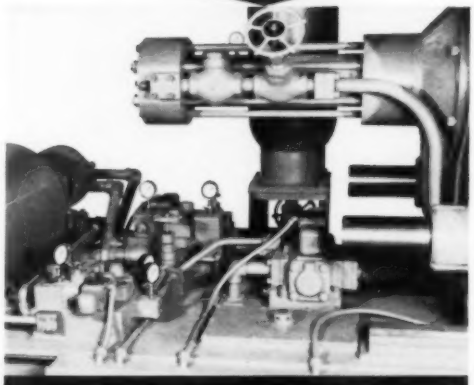
PUBLICATION OF THE SOCIETY OF DIE CASTING ENGINEERS

The STANDARD *Hydraulic* SYSTEM OF B & T DIE-CASTING MACHINES





1. MEETS J. I. C. SPECIFICATIONS!

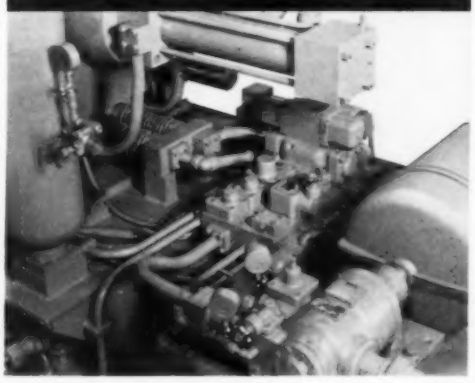
...a very important consideration in comparing both price and performance. For, this superior system of panel mounted hydraulics eliminates unsupported valves and threads between high pressure connections... permits very easy removal of valves for repair or replacement.

2. ELIMINATES LEAKAGE LOSSES!

Non-inflammable hydraulic oil is expensive and leakage losses are costly. With the B&T STANDARD system, loss of oil is negligible. Pipes have weldon fittings, socket welded to flanges which are bolted together with an "O" ring seal between mating surfaces to prevent leaks. Leaks cannot be caused by the normal hydraulic surges of a die casting machine because B&T uses heavy, rigid piping clamped firmly to the base at frequent intervals.

3. CUTS MAINTENANCE COSTS!

The B&T method of piping also saves time in disassembly, since it is only necessary to remove 4 bolts at each end of a pipe to free it from mating cylinders or parts.



The superior hydraulic system of B&T Die Casting machines is just one of several outstanding features that suggest the wisdom of thoroughly investigating B&T before buying any other. The line includes High-Pressure Cold-Chamber and Hot-Chamber Gooseneck types... in capacities of: 125, 150, 200, 300, 400, 500, 600, 700, 800 and 1,000 tons.

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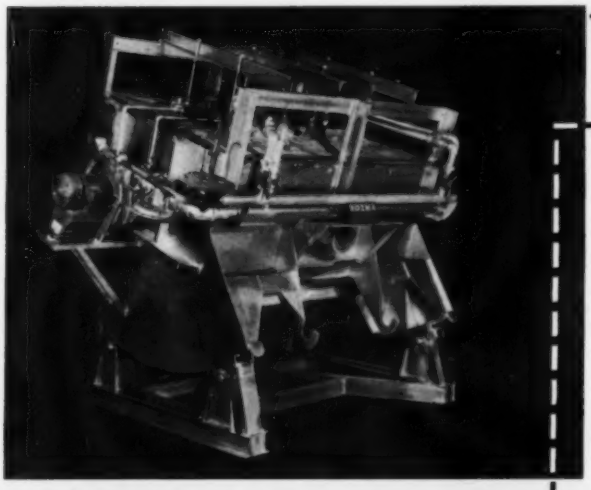
DIE CASTERS LOOK TO KOZMA FOR THE GREATEST ADVANCES IN ALUMINUM MELTING AND HOLDING FURNACES

With the tremendous expansion now taking place in the aluminum die-casting industry, more and more manufacturers are turning to the J. A. Kozma Company for skillfully-engineered melting and holding furnaces.

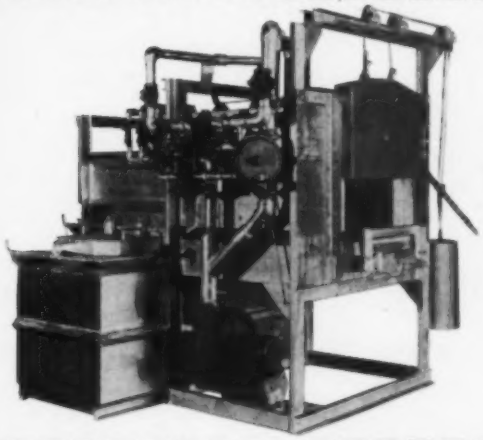
KOZMA RADIANT-FIRED FURNACES are designed for maximum economy on all die-casting and permanent-molding operations. Kozma Radiant Panels eliminate flame impingement and localized overheating, thus keeping metal loss to a minimum. Direct, uniform heating provides faster melting and higher efficiency to assure top fuel economy. **The result is an overall reduction in metal-melting costs!**

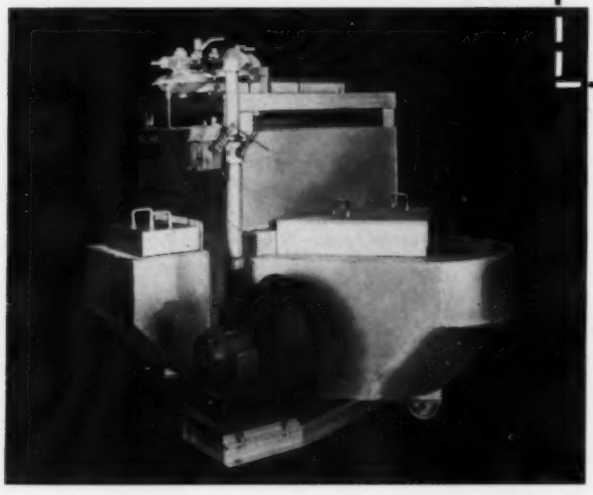
Kozma's current research program predicts much greater things to come in die-casting furnaces. Furnaces that virtually eliminate porosity and oxidation are now being perfected for use where highest metal quality is essential. These new developments will be announced in the near future.

For all of your melting and holding requirements . . . even those that are highly specialized . . . consult our engineering staff first. You are assured of receiving maximum production economy, latest technical information and top-notch service.



KOZMA MODEL RT TILTING REVERBERATORY FURNACES feature well-type charging apertures for immersion melting of ingots. Tilt through a 20 degree arc to charge integrally-hung ladle. Ladle can be transferred by fork lift truck. No overhead equipment is required. Capacities from 500 to 2,000 lbs. per hour.





KOZMA MODEL R DRY-HEARTH MELTING AND HOLDING FURNACES are radiant-fired for economical operation. Compact design requires less floor space, while a reduction in heat loss provides greater operator comfort. Increased refractory life is assured. Available with either side or end dip-out arrangement. Melting capacities from 250 to 2,500 lbs. per hour and holding capacities from 900 to 2,500 lbs.

This KOZMA MODEL RH HOLDING FURNACE was specially designed for use with aluminum vacuum die casting machines. Roller bearing wheels and a unique dipwell permit installation of the furnace as an integral part of the die casting machine. Kozma Model RH Holding Furnaces have been specified by a well-known manufacturer of die casting machines and by a leading producer of aluminum for use where highest quality metal is a "must". Bath capacities and dipwell design to meet your requirements.

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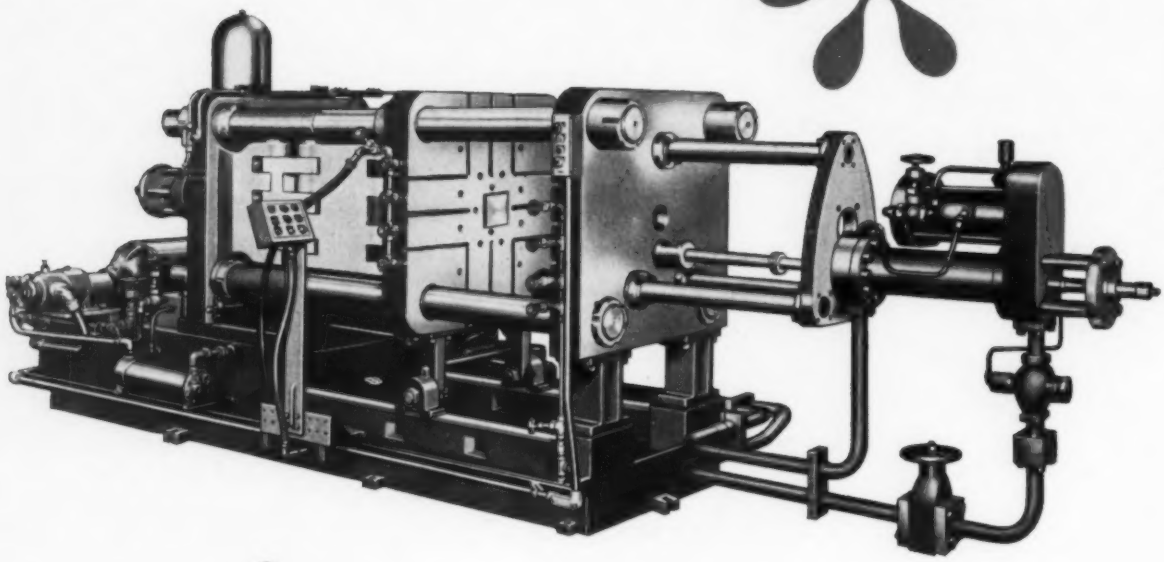

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Tie Bar Diameter		5½
Space Between Tie Bars		23 HOR. 25 VER.
Die Mounting Plates		7x38x40
Die Thickness	Min. Max.	8 36
Die Stroke	Min. Max.	9 15
Locking Pressure (tons)		500
Injection Cyl. Diameter		4⅝
Injection Cyl. Stroke (Adj.)		14 to 19½
Shot Position		on center and 6" below center

(All dimensions in inches)

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VOLUME 3
NUMBER 4
DECEMBER, 1959

DIE CASTING ENGINEER

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COVER

Milwaukee-Matic's high-speed, automatic tool changer. The rotary tool magazine is loaded with 30 all-different cutting tools, from shell end mills to boring tools to taps, each chucked in a coded holder. *Story on page 9.*

The DIE CASTING ENGINEER is published quarterly by The Society of Die Casting Engineers, Inc.—a society for the improvement and dissemination of the knowledge of the arts and sciences of die casting, the finishing of metals, and the allied arts. The DIE CASTING ENGINEER offers a concentrated coverage of management and engineering in the die casting and directly related industries.

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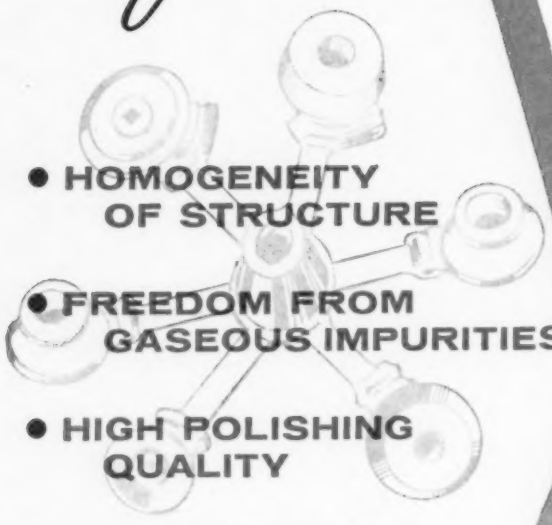

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Parting Line

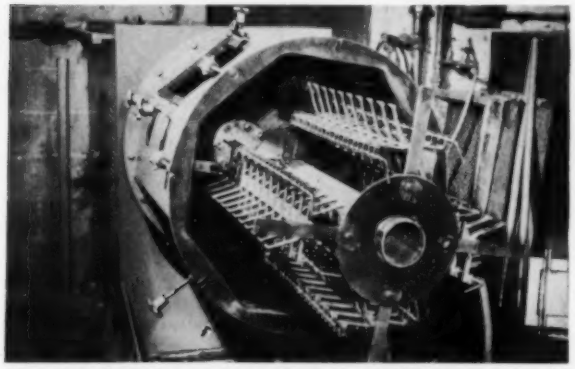
Roll Bright Corporation
September 1, 1959

To the Editor:

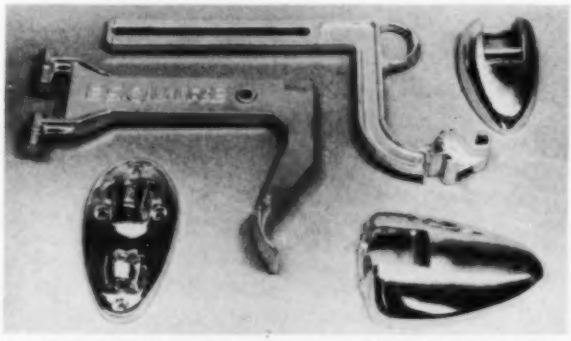
It is unfortunate that you were unable to use the photographs accompanying the article *Fixturing Aluminum Die Castings in a Tumbling Barrel*, ***DCE**, June, 1959*, inasmuch as they are quite impressive in illustrating the quantity of parts that can be racked in a Roll Brite barrel.

(*signed*) John J. Morrison
Vice President

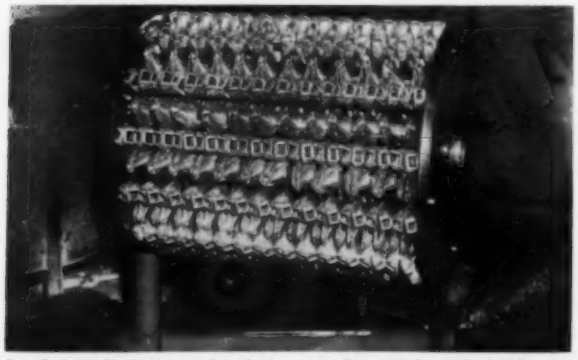
Ed.: Unfortunately the photographs arrived after the issue had gone to press. A selection of the photographs are printed below as a supplement to the article.



Note the telescoping arrangement of the Roll Brite rack on the center supporting shaft. An empty rack is used for clearer illustration of the principle.



Set of five aluminum die castings comprising the Esquire Shoe Care Bar after Roll Brite finishing for one-half hour.



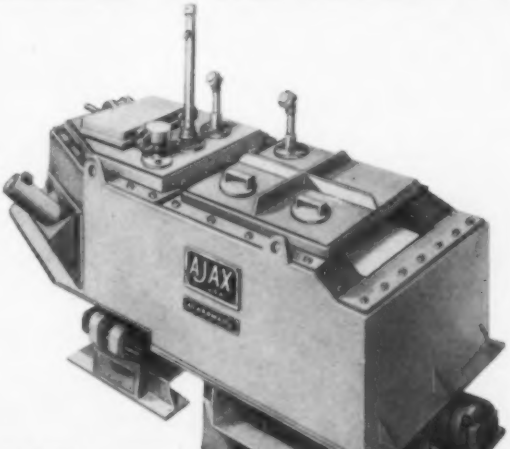
Loaded Roll Brite rack after processing. This rack holds the Esquire large toes, small toes and back plate in combination. Rack is unloaded by pulling out steel rod through a string of parts.

AJAXOMATICS
bring automation to die casting

The Duplex AJAXOMATIC melts aluminum pig and gates right at the die casting machine. By pushing a button the operator initiates the complete casting cycle: the die closes and the Duplex AJAXOMATIC pours the exact required amount of molten metal directly into the cold chamber. The operator just removes the finished casting at the end of the cycle.

Automation, however, is only part of the AJAXOMATIC story. The Duplex AJAXOMATIC also gives assurance of consistent quality. The quality of a finished casting begins with the proper melting of the metal. 60 cycle induction with its two basic features of internal heating and electromagnetic stirring is used exclusively in the Duplex AJAXOMATIC. Here are the unique characteristics of the Duplex AJAXOMATIC:

- Precision temperature control —at low temperature
- Alloy uniformity —no segregation
- No gas porosity
- Low metal loss
- No supply ladle system or hand ladles
- Precise weight of automatic pour
- Comfortable working conditions
- Low maintenance



DUPLEX
AJAXOMATIC

The standard Duplex AJAXOMATIC is rated 120 kw to produce 500 lbs per hour of castings ranging from ½ lb to 30 lbs. Other AJAXOMATICS are available to suit a wide range of production requirements, including units supplied from central melting systems. May we have an opportunity to study your requirements?

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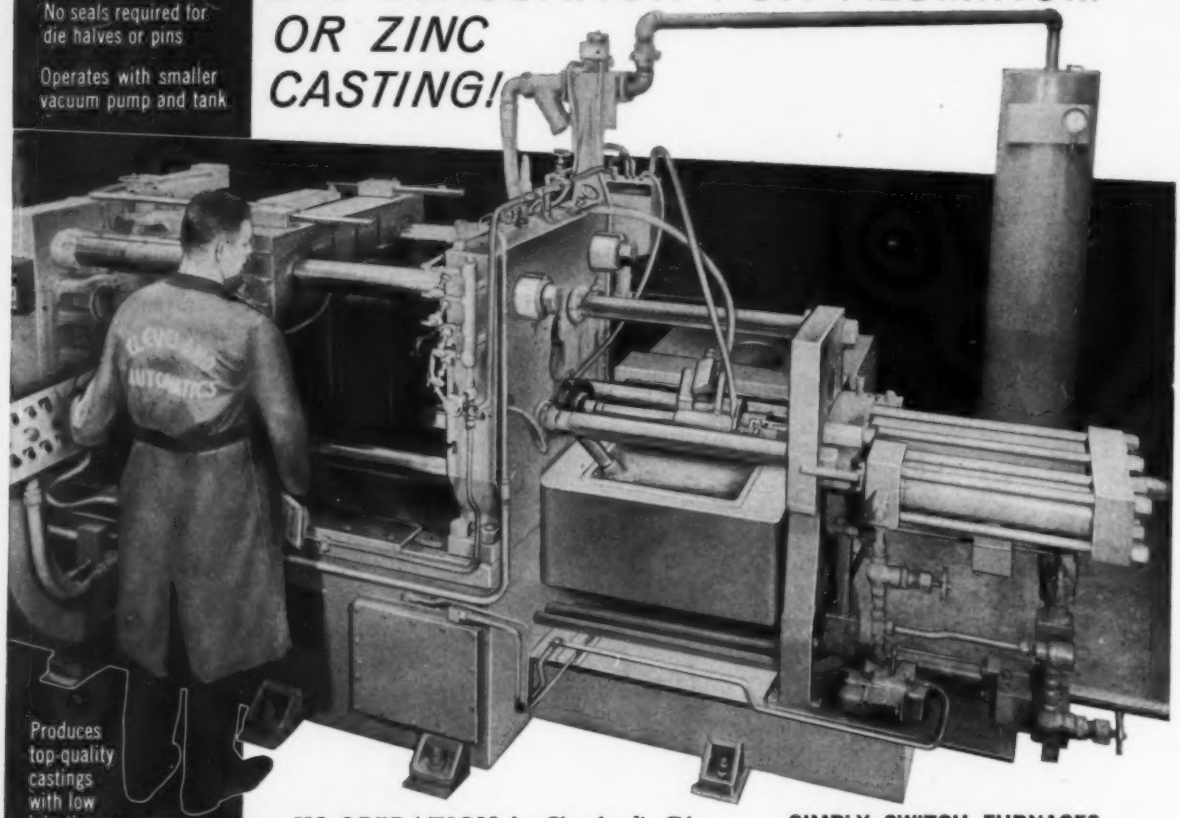

- Produces top-quality castings with low injection pressures
- Provides fast operation with less operator attention
- Machine maintenance reduced to minimum
- Less flash—cleaner dies—fewer rejects
- Automatic die and machine lubrication including plunger tip
- Template-programmed operation sequences
- The ultimate in machine operation flexibility

IN OPERATION in Cleveland's Die Casting Development Center is the 400-ton Cleveland 400-N Machine shown above. This Cleveland incorporates the lowest cost, most efficient vacuum ladling and die evacuation system in existence today!

For months, this machine has been producing an extremely thin-walled aluminum casting, having near-zero porosity and superb surface finish, at rates exceeding 300 shots per hour.

The casting is produced with a 4" dia. shot cylinder from a 1000 lb. charge in the accumulator, and by automatically ladling the aluminum and evacuating the die and shot cylinder from the vacuum system, which operates under a vacuum of 29.6 inches of mercury. No shrouds or die seals, etc., are used. (If desired, a 2000 lb. shot pressure, or an intensifier to provide 5000 lbs., can be supplied.)

SIMPLY SWITCH FURNACES TO CHANGE FROM ALUMINUM TO ZINC PRODUCTION

Note the unique furnace arrangement shown. This is a 30KW induction melting furnace on wheels, riding on rails. The entire furnace can be rolled out from under the shot end. By mounting another die, rolling in a second furnace charged with a different alloy or metal, and re-programming the machine controls, this Cleveland is quickly back into production!

A few of the many advantages of Cleveland Vacuum Die Casting Machines are itemized at the left. To convince yourself of Cleveland's superiority in vacuum die casting, schedule your visit to see this machine in operation, or call in a Cleveland field engineer.

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AUTOMATION IN MACHINE TOOLS

by W. E. BRAINARD

Chief Engineer, Numerical Control Division
Kearney and Trecker Corp.
Milwaukee, Wisconsin

THE TOOLS OF ALL INDUSTRIES today, be they manufacturing, farming, processing, publishing, or other, are necessarily economic compromises. If it were not for the problems of procurement money, newer and more modern tools would enable the people in these industries to produce much more in less time than is now required. If a complete modernization could be accomplished overnight, and if the company could adjust itself to the shock, we could all go on a shorter work-week and still produce enough extra cars, homes and gadgets to go around.

We are not nurturing any ideas about the automatic factory with an all powerful computer in the back room, nor do we visualize the farmer harvesting his cotton with an electronic device controlled from his front porch.

Our prejudice is this: that numerically controlled machines, which run almost untouched by human hands from instructions punched on tapes or cards, will so greatly reduce the cost of building the tools used by industry that the economic pressures now preventing the complete modernization of these industries will be reduced. In this event, increased quantities of consumer goods will be produced and decreased labor hours will naturally follow.

We are saying that the farming and mining machinery; printing presses and food processing equipment; pumps, motors and cranes; transfer machines, presses and machine tools; and a multitude of other industrial equipment can be produced by numerically controlled manufacturing machines so inexpensively that general industry will not be able to further postpone modernization. The true role of numerical control is to build the machinery used to produce consumer items.

In our particular segment of the machine tool industry we have moments of intense dissatisfaction. We build mechanical transfer lines and special automatic machines for many consumer products. These machines are tested out on our erection floors before shipment. We see a part loaded and automatically completed in a short time. We watch these parts flow through their stations and emerge ready for assembly at rates of one every minute or so.

To make these machines we sweat out the components from machine to machine, pick them up and load them ten, twenty or thirty times, stack them up between operations, and take several months to prepare the components which, when put together produce parts so quickly in our customers' plants. Little wonder then that the cost of such manufacturing equipment is so great that only a few can justify the expenditure. We are quite tired of all this. Kearney & Trecker's best customer for numerical control will be Kearney & Trecker.

A versatile, automatic tool changing, tape controlled combination machine, the KTNC Milwaukee-Matic, has been developed by Kearney & Trecker Corporation with General Electric Company supplying the program controls, Figure 1. This machine makes flexible automation economically feasible for small-lot manufacturers.

For the first time, a combination machine which performs milling, drilling, reaming, tapping and boring operations bridges the gap between job shop mechanization and automation. By reducing setup time, production time, labor costs and inventory, this machine can pay for itself in one to three years for any manufacturer producing goods in small or medium lots.

The production capacity of the machine, called the Milwaukee-Matic, is equal to that of several conventional machines. Metalworking statistics show that standard machine cutting time averages only 15 to 25 percent. By minimizing setup and positioning time and by combining milling, drilling, reaming, tapping and boring functions in a single machine, the machine can be kept in operation well over 75 per cent of the time.

As many as 31 different tools can be loaded into the machine at one time, 30 in a specially designed revolving tool storage drum and one in the spindle. There are 31 different combinations of 31 tools, ranging in size up to 2½ inches in diameter, that can be utilized by the machine, making a total of 961 tools.

To make tool changes, a transfer arm automatically pivots out from its position beside the drum, simultaneously removes the tool from the spindle and a new tool from the tool storage drum, rotates, simultaneously inserts the new tool in the spindle and the other in the drum, and returns to its normal position, Figure 2. Less than nine seconds are required for tool changes.

The General Electric control system makes the tool selection and directs the workpiece transfer. If the programmed tool has not been loaded into the drum by the operator, the drum will continue to revolve until it is stopped and the proper tool is inserted. Tools carry a binary code and can be placed at any position within the drum regardless of the sequence in which they are to be used. Mechanical "fingers" feel the tools and signal the control to stop the drum when the desired tool is in position to be removed by the transfer arm.

In operation, the worktable is automatically indexed to present workpiece surfaces to the spindle. The spindle moves longitudinally, vertically, and to depth. Feed rates range from

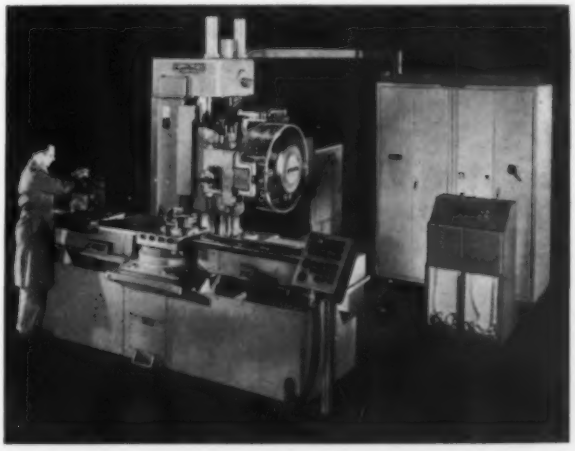

FIGURE 1—A flexible automated machine center receiving all its operational commands from the General Electric program controls (right), the Milwaukee-Matic is shown in action. Workpiece setup does not interfere with machine operation. At the same time the machine is completing a part, the operator is securing another part, entirely different, to a pallet parked on the shuttle mechanism.

1 to 99 inches per minute and are selected in increments of 1 ipm. Spindle speeds from 100 to 4,000 revolutions per minute are selected in increments of 10 rpm.

As the spindle is used for tapping, a complete reversal requires 0.1 second at 100 rpm and 0.4 seconds at 400 rpm. Acceleration of the feed drives to 100 ipm is accomplished in 0.05 seconds. Where feed rates are not specified, positioning is done at 200 ipm.

The Milwaukee-Matic is equipped with a numerical control system developed specifically for this application by General Electric's Specialty Control Department, Waynesboro, Virginia. The new control system makes the entire machine automatic. It not only directs positioning of the work table and three-axis spindle; it also controls tool selection, tool changing, spindle speed, feed rate, and auxiliary functions such as turning coolant on and off and shuttling work pallet between the index table and load and unload stations.

When the tape controlled machine is cutting curved paths on a complex workpiece its capabilities show up the best. Here the curves are produced by simultaneous motions on two or more axes. Commonly, motions of the longitudinal and transverse axes are combined to cut circles and arcs. At points of inflection with respect to an axis, one of the motions slows down to a stop, then slowly starts up again in the opposite direction. This is a severe test of the precision of the system. If there is any undue lag due to friction, lash, or hysteresis, a step will show at this point. Such steps are very difficult to eliminate, but their magnitude is often such that they disappear among the normal tool marks. Their complete elimination would require the ultimate system, which is not yet in sight.

The machine will perform circular cutting of radii from 0.1 to 9.9 inches in radius increments of 0.1 inch. The maximum error on arc milling is plus or minus two percent of arc length. Maximum speed for arc and slope cutting is 30 ipm for radii between 0.5 and 9.9 inches. The control permits users to mill clearances, "walk" around joint faces, and perform similar jobs where high accuracy is not required.

The first step in processing a part for the machine consists of listing dimensions, machining sequences and auxiliary functions on a simplified planning sheet. To do this, the engineer or technician takes the necessary information from an ordinary blue print. His planning sheet is very similar to that used for single spindle screw machines. Ordinate addition and subtraction is the only mathematical requirement, except for contouring, where high school trigonometry is helpful. Then a typist, using a standard typewriter-tape punch, transcribes the planning data sheet. To provide a visual check of the accuracy of the transcription, corresponding numbers are typed onto the planning sheet at the same time they are being punched into the input tape. The input tape is one inch wide with eight information channels, in accordance with EIA and AIA proposed standards. After checking the typed numbers against those originally placed on the planning sheet, the tape is ready for use. If corrections are necessary, tapes can be readily duplicated with only the changed data requiring attention.

At the machine, the tape is read by a standard Commercial Controls tape reader. This is a simple mechanical reader since a complex high speed reader is not required. The control system has dual registers, eliminating any loss of machine time due to the reading of tape. Stepping switches are not used except for an auxiliary visual read-out device.

A push of a button is all that is required to put the versatile combination machine into operation. Once started, it will continue to function automatically until the programmed job is completed. While the machine is in operation, the operator is free to prepare the next workpiece for production and to select the necessary tools required if a new part is to be machined. This makes possible a complete changeover in minimum time.

Spindle speed and feed rate commands are stored in a precision resistor network for servo control from tachometer feedback. A small instrument analogue computer about the size of a shoe box does all the interpolation required for arc and slope generation. This is started, controlled and stopped automatically from two instruction blocks on the tape. Position commands in increments of 1/10,000 inch for longitudinal and vertical and 1/1000 inch for depth are stored as discrete addresses in the form of sine and cosine voltage ratios. Course position feedback is from resolvers, fine position is from Farrand Scales on the X or longitudinal position and Y or vertical position.

Machine axes are powered by hydraulic motors controlled by a dual servo valve arrangement. By so doing, performance at extremely slow feed rates is not impaired by the larger fluid requirements of traverse. In effect, this is a two-speed system.

The motor, through a single mesh of spiroid gears, turns a large diameter screw with a recirculating ball nut. The screw is restrained at each end by dual anti-friction bearings loaded in pairs. To illustrate how rigid this drive system is,

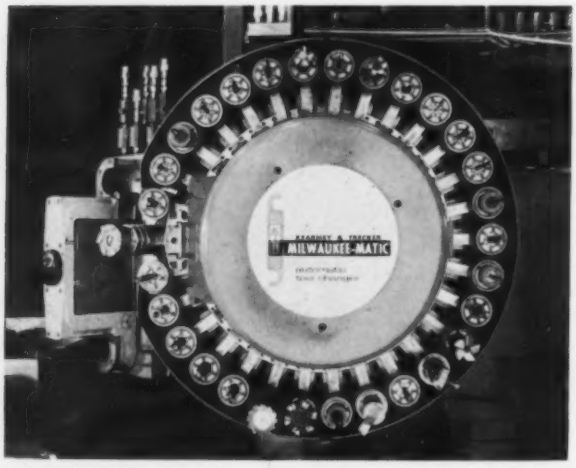

FIGURE 2-1—The rotary tool magazine loaded with 30 all-different cutting tools, each chucked in a coded holder. The tool change arm and the selected tool holder are in the first phase of the 8-second changeover.

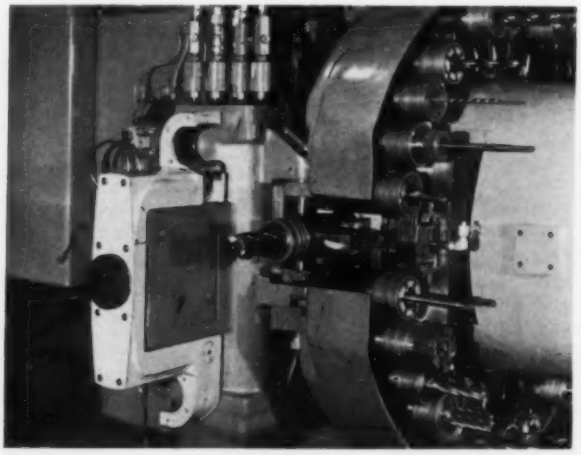

FIGURE 2-2—The tool change arm and the selected tool holder in the transfer position.

the 20,000 pound column mass, through the drive system, has a natural vibration period in excess of 70 CPS in respect to the bed.

The weight of the column is partially supported on anti-friction roller cartridges which serve a dual purpose of reducing the friction load and of maintaining a predetermined oil thickness between panelyte slipper pads and hardened ways. Accordingly, a constant oil film shear rate is obtained. As a result of friction characteristics and machine stiffness, the stability of the servo system allows a gain of approximately 200 IPM per .0001 inch error. Positioning accuracy is adequate and surface finish deterioration from tool load reactions is not apparent.

Economics of numerical control

We all know that if one is to manufacture a single part, it will be made on conventional tool room type milling machines, drill presses, jig borers, etc. Rarely will any special tooling such as holding fixtures or drill jigs be justified. If more than one similar part is to be made, the no tool method may suffice and although we sometimes do not think of set-up in such occurrences, actually a labor saving will result since many of the make-ready chores will not require repetition.

However, if it is known that eventually, perhaps within a year or two, a total quantity of 50 or 100 parts is to be made, it usually proves better to make simple holding fixtures and drill jigs, and quantities of ten or so repeated every few months becomes the best solution. This is minor tooling.

If the ultimate quantity is a thousand or more, lot sizes in the order of a hundred yield better costs. In this event, faster operating tooling, shuttle fixtures, multiple drill heads, gang cutters and similar devices are justifiable. We will call this major tooling. Figure 3 shows, in a general way, the relationship between the three methods.

It will be noted the major tooling program may produce unfavorable labor costs for extremely low lot sizes because of higher set-up costs. It will also be observed there is a flattening out trend for all methods, as lot sizes become sufficiently large to allow the step-up allocation per part to become negligible.

The implications of the trends we have just considered are varied. Before spending further time in analysis, let us broaden the picture by introducing a very important factor, the cost of tooling. Let us take the generalized trends of Figure 3, and assume four lots per year for five years and write-off typical tooling costs, minor and major as a cost per piece.

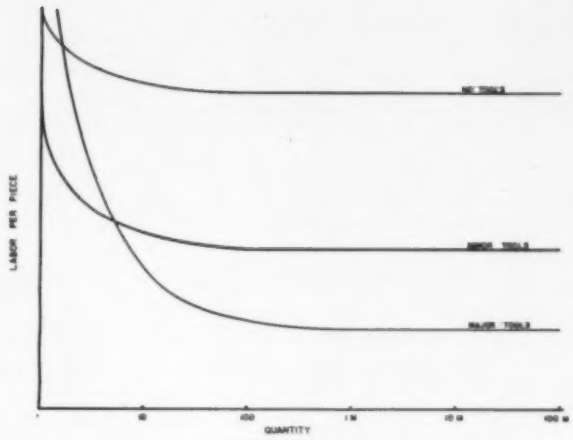

FIGURE 3

We submit that a five year tool write-off is conservative. The heavy lines of Figure 4 now include the tooling write-off, while the dotted extensions are for labor only.

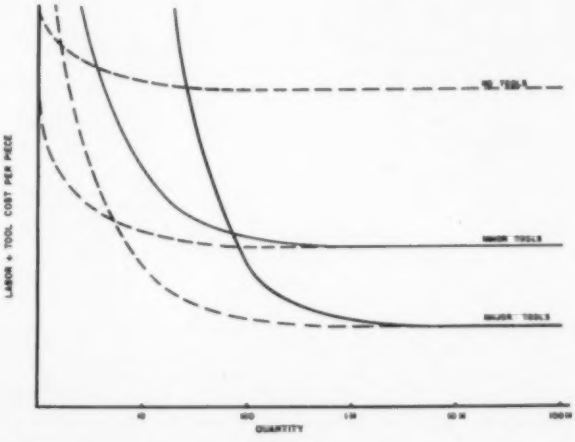

FIGURE 4

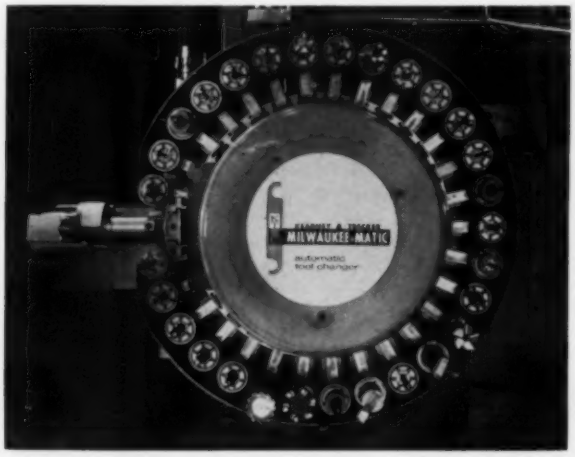

FIGURE 2-3—The tool change arm is fully extended, simultaneously gripping the tool holders in both the magazine and the spindle. The tool selection reader head can be seen directly to the right of the selected tool.

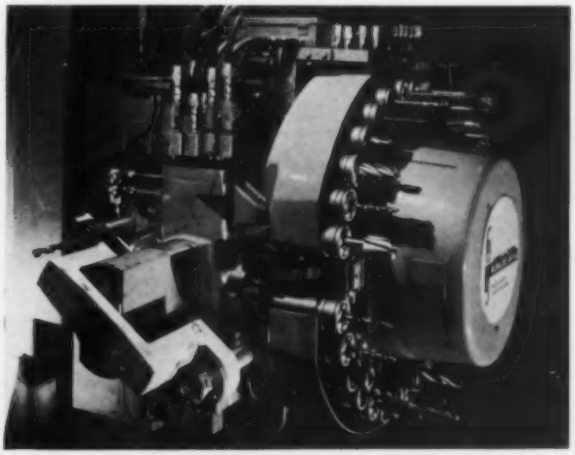

FIGURE 2-4—Tools have been removed from both the spindle and magazine socket, and the tool change arm is in the process of making the actual change.

If we study these curves, certain conclusions may be drawn. It is obvious that a minor tooling program is perfectly justified if but a few parts per year are required. We seem to be on safe ground for lot sizes up to several hundred. However, a major tooling program is indeed a gamble. These cost pressures are volatile in the event of an unrealized production rate or unforeseen obsolescence, because of competitive economic or internal developments. Brave and farsighted indeed is he who embarks upon this course of action as the depleted or vanished earnings of so many bear witness during any period of recession.

Our analysis requires another step before embarking upon the numerical control rescue concept. Let us add one more curve to Figure 4—the relationship of mechanized automation. Here, again, we are writing off the tooling cost, the special transfer line or machine, over a period of five years normal production, Figure 5.

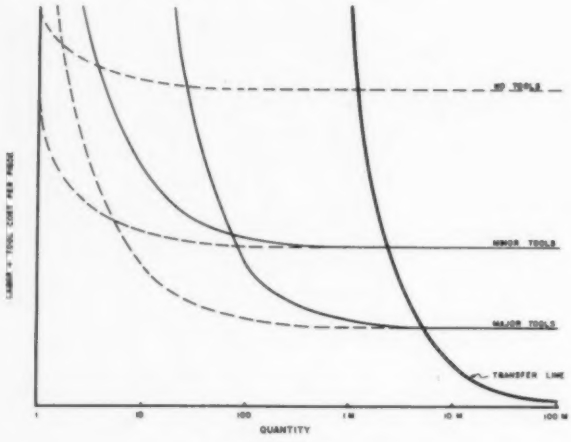

FIGURE 5

Transfer lines are by no means as inflexible as some have thought. They can be run for one hour per day, or around the clock, with little effect on labor cost per piece. However, the write-off of the line can quickly produce staggering price costs in the event of decreased market conditions. Nevertheless, this method is supreme within its production rate limitations and there may not be any competition from numerical control as we see the picture today.

At this point our study illustrates the tremendous gap between the no tool method and automation. The spread between piece part costs is so great that ratios are meaningless. One either has or does not have a justifiable production rate requirement and the money for automation. Between these two extremes lie the tooling compromises. As costs are lowered, the reliance upon planned production rates to avoid catastrophic risks becomes proportionally greater. So called calculated risks approach the uncalculable. Also, between the no tool-automation boundaries lurks another demon, that of work-in-process inventory. Machine shops become warehouses and swarms of efficiency experts are busy painting large white lines around storage areas and designing fancy boxes and trucks to move parts.

The gap in unit cost is presently populated with many one-function machines, many tools and fixtures, set-up costs, high inventory costs, material handling labor and gadgets; long lead time; indirect labor costs such as dispatching, expediting, machine loading and scheduling; in process cost control; etc. A jaundiced point of view? Certainly! Well, what about numerical control? Can it bridge the gap?

The trick, after it has been done, is very simple. We will not dwell on the aches and pains of developing the idea to fulfillment, that is another story. It was merely decided that we needed a machine which would immediately accommodate itself to the requirements of a workpiece and automatically complete the job, whatever it might be, as expeditiously as a transfer machine but with such complete flexibility that any lot size, even a single part, could be run.

This means the machine must lose no time in set-up or workpiece loading and must be unaffected by workpiece material, cutting tool requirements or part configuration. It must remove the right amount of metal from the proper place as rapidly as cutting tools will allow. It should be just as simple as inserting a dime in a juke box and getting the rock n' roll of your choice. It also should make almost as much money as the juke box. We have not batted 100% on these requirements as some compromises were inevitable. Here is how we compromised.

We arbitrarily assumed a 5,000 hour pay-off requirement. This means the machine, if substituted for conventional facilities, should pay for itself in about 18 months on two-shift operation.

For example, in deciding how fast a traverse rate was required, the increased machine cost of higher rates was evaluated on the basis of studied frequency of occurrence and a break-even point was established. By this method, feed rate ranges, acceleration rates, indexing and tool changing times, spindle horsepower and RPM range and other parameters were established.

During the past few months perhaps 40 or 50 different plants from almost that many different industry segments have sent their process men to our plant in Milwaukee. They brought with them representative component parts and prints. In a week's time these men learned how to plan for the machine, prepare the tape sheets and analyze the time requirements. Holding fixtures, usually only one is required, were sketched and their costs estimated. These costs were then compared with the existing actual costs, using the usual methods. On a few of the parts the machine showed very little improvement over existing methods. On well over 80%, however, the machine pay-off time ranged from slightly less than one year to two years. Figure 6 shows the Milwaukee-Matic in its gap bridging position, based on this initial sample of several hundred workpieces.

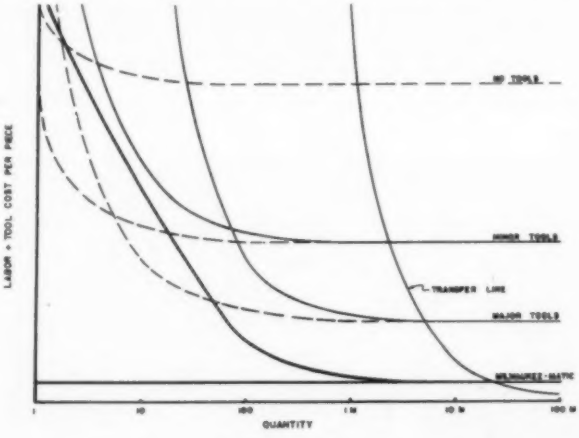

FIGURE 6

Numerical control will allow industry to take immediate modernization action because the equipment so urgently needed can be produced at reasonable costs. The tape controlled machine tool has the necessary talent to produce built into its tapes, and the capacity to follow directions is inherent in its servo system. It can literally revolutionize our entire productive structure if we let it. Its popularity is already increasing by geometric progression, and soon hardly any branch of industry will be untouched by it.

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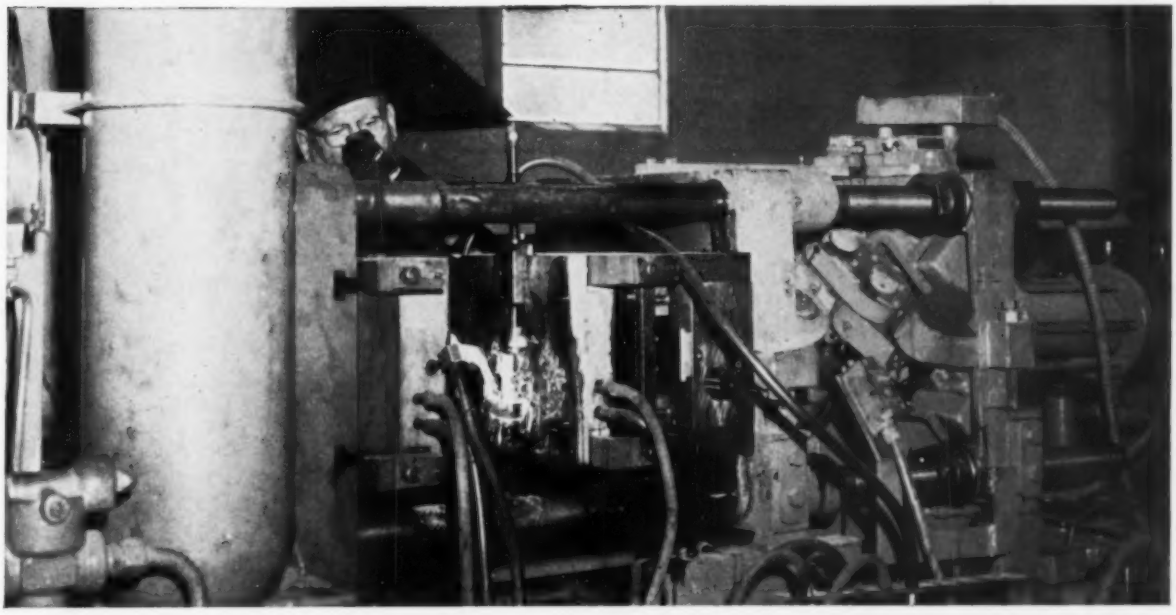

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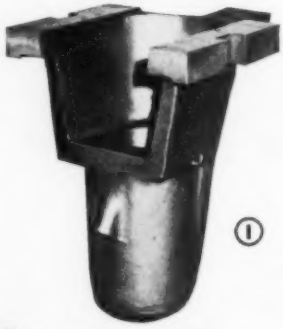

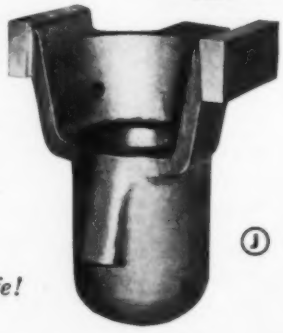

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POLISHING AND BUFFING DIE CASTINGS

by ROBERT WESLER

Process Engineer
Acme Manufacturing Co.
Detroit, Michigan

MAXIMUM ECONOMY IN POLISHING AND BUFFING DIE CASTINGS prior to plating operations is achieved when the die castings are smooth and free of glazed spots. Castings with cold spots or chills cost more to finish because abrasive belt polishing has to be performed ahead of buffing operations. This means that die casters should clean their dies frequently and repolish them when necessary to avoid these conditions.

Accuracy of the trim operation is another important cost consideration. When trim on the parting line is not smooth, again it may be necessary to add abrasive belt polishing operations ahead of the buffing.

The shape advantage offered by the die casting process as far as appearance, design and unified part construction is concerned has added to the problem of the finisher. An attractive, uniquely shaped part may require the ultimate in machine design ingenuity to polish and buff it to a finish where a satisfactory plated finish can be achieved. For the polishing and buffing tools must reach into every niche and cranny of a part to make certain that a smooth, uniform plated surface can be produced on it. The normal sequence of finishing a part for plating is to first polish the part with an abrasive belt and then buff it with a buffing wheel. The better the die casting the less is the amount of polishing required.

The finishing of die castings for plating operations has been, and may always be, a sort of a production development. Every shape of die casting offers different problems that can usually best be worked out by empirical methods. There are often a variety of belt and buff materials, lubricants, speed combinations and sequences that will achieve the same end finish result. The problem is to determine the one that will provide the best finish at minimum cost. That is why many methods should be tried out experimentally on actual production parts before the final finishing sequence and machine are specified.

The tools of the finishing profession also have many variables within themselves. Abrasive belts are furnished in a host of grit and material sizes. Usually a coarse grit is used for heavy flash removal; and this is often followed by a polish with a fine-grit belt before buffing. Unless there is extremely heavy stock removal required, it is best to use lubricant in connection with belt polishing operations on die castings to avoid belt loading and improve the work finish.

Buffing wheels are made in a variety of types by a number of reputable manufacturers. The ventilated air-cooled buff is a popular design that is made with different hole center diameters. Smaller hole sizes provide more buff flexibility for following contours and deep sections. The buffing operation is also carried out in a sequence from cutting to coloring that is achieved by varying the buff hardness or the cutting compounds. The hardness variation in buffs is achieved by varying the number of plies and the weave of the buff material.

In buffing there are several operation variables. These include wheel direction and speed, buff material and design, cutting compound and wheel contact time. The proper answer to economical buffing lies among these variables. When it is desired to have a cutting action with a buff, the work can be passed by in opposition to the rotation of the buff. Coloring action is achieved by feeding the work in the same direction as the buff rotation.

Positioning the work for the polishing and buffing operation is a complex machine design problem. When parts are made in low production, it is feasible to buff them by holding a part in the hand in contact with a buffing wheel mounted on a buffing lathe. However, maximum economy in polishing and buffing die castings is achieved by using as many

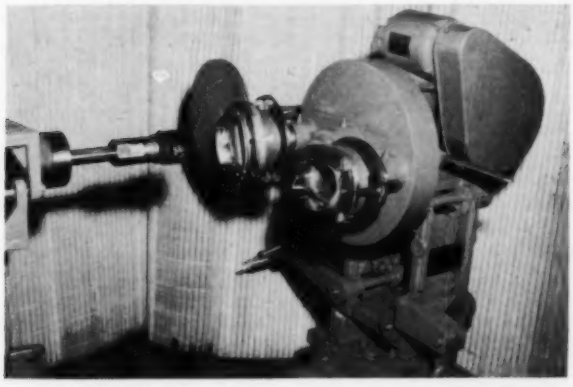

FIGURE 1—Polishing a die-cast bevel for a rear view mirror on a semi-automatic machine. A two spindle, indexing work fixture enables the operator to load and unload a part while another is being polished. The spindle is cammed to follow the work shape.

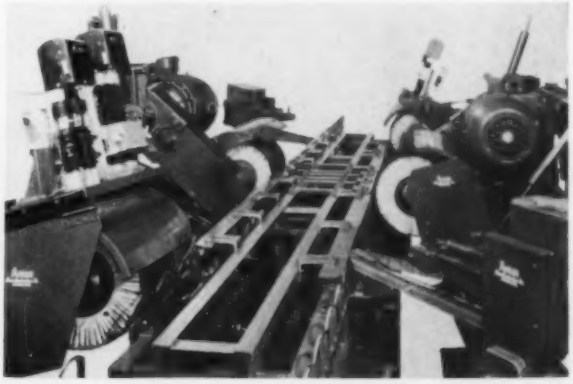

FIGURE 2—A horizontal-return, straight-line machine for polishing and buffing die cast drawer pulls. One side of the machine finishes one side of the parts, the other completes the finishing of the opposite side. Six pulls are in each fixture. Note the abrasive belt polishing head in front of the two buffing stations at the right.

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automation principles as possible. The size and type of the machine depend upon the number of part areas that have to be finished and the amount of production required per hour.

The first automation step beyond a hand lathe setup is the semi-automatic machine, Fig. 1. This machine consists of a buffing wheel mounted on an adjustable lathe and a part-holding fixture that provides controlled movement wheel pressure and time cycle. Parts can be unloaded and loaded while other parts are being finished.

Where more than one side of a part has to be finished, or where more than one finishing operation is required, a straight-line type of machine can be used. In the lower casting production ranges a straight line machine may be of either

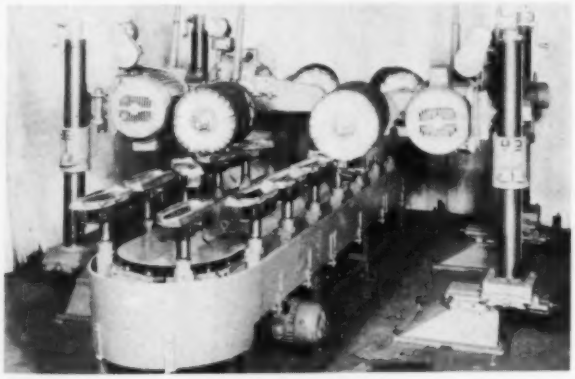

FIGURE 3—A 32-foot long universal straightline machine for buffing a die cast instrument panel housing. Parts on individual work spindles travel around this machine. The spindles can rotate, move under cam control or rotate at any position along the closed loop line.

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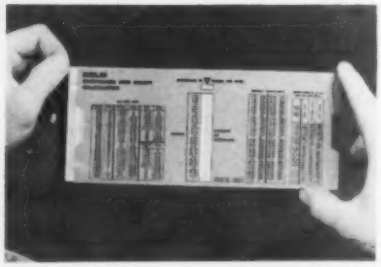

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a reciprocating type or a fixture-return type. In the first type, the fixtured part or parts are automatically reciprocated back and forth between rows of adjustable belt heads or lathes with buffing wheels. In the latter type the fixture is returned to loading position by gravity, belt conveyor or related type of feeding device at the side of the line of lathes or belt heads.

Die castings are normally high production items and they are ideally suited to the more sophisticated forms of highly automated polishing and buffing machines. The continuous rotary machine is one of these high production types. It enables a series of polishing and buffing operations to be performed while parts are unloaded and loaded at an open section of the periphery of the rotary table. The parts can be rotated, cam-positioned or held stationary during the various sequences.

In its more highly automated concepts, the straight line machine can take on the form of the horizontal-return type, Fig. 2. In this type, fixtures mounting one or more parts are traversed in a closed loop past a series of polishing and buffing heads. At the end of their passage by one line of heads, the fixtures are moved horizontally and travel down the opposite line with the opposite part face exposed to the wheels. In another form of the straight-line design, the closed loop conveyor is tipped up on its side. This arrangement allows both sides of a die casting to be finished simultaneously and return underneath for unloading and loading.

The present demands for more flexibility in automatic polishing and buffing machines for die castings are being satisfied with an unusual universal type of machine, Fig. 3. In this machine, spindles are mounted on platens and travel in a closed loop past series of polishing and buffing units. Each spindle can be rotated, cam-positioned or held stationary for a particular operation. Where more operations have to be performed, the center of the machine can be opened up to either a rectangular or circular closed loop. Thus polishing and buffing units can be placed both inside and outside of the moving line.

There are often many times when die castings are of such unusual shapes or have specific production or design requirements that a special machine is the most economical solution.

On the quality of finishing depends, in a large measure, the quality of the plated or organic finish of any die casting. So many factors enter into the selection of the proper finishing method and equipment that no one machine or method will suit every job. It may be advisable to check with a manufacturer for suggestions as to the proper equipment for your job.

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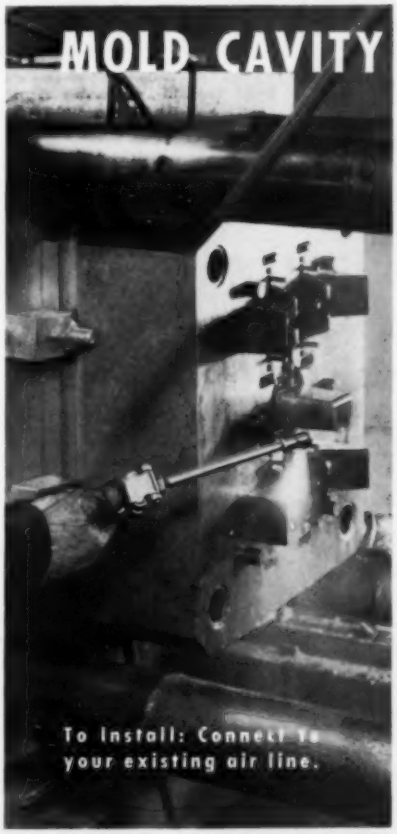

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SDCE News

THIRD INTERNATIONAL PRESSURE DIE CASTING CONFERENCE

The Society of Die Casting Engineers, Inc., is sponsoring a European Tour in conjunction with the Third International Pressure Die Casting Conference in Stresa, on Lake Maggiore in Italy, from the 16th to 20th of May, 1960.

Mr. Harry Cagin, of Halex Die Casting Company in Cleveland, Ohio, Chairman of the European Tour, has planned an exciting four-week program for members of the Society, departing April 30th. Arrangements have been made for the group to visit many plants of special interest. Members will observe vertical shot type die casting machines; novel methods of secondary operations; pin point gating in cold chamber machines; and a rugged four-tie bar machine operated by an electric motor-driven set of cams.

An interesting "pleasure" program in addition to the Conference has also been arranged. Special sightseeing and shopping opportunities will be offered the ladies, during plant visitations and during the Conference. The group will spend several days in London, Paris, Cologne, Heidelberg, Zurich, Lucerne, Stresa, Venice, Florence, and Rome.

Combining these pleasure visits with personal visits to some of the largest and most interesting die-casting plants in Europe, along with attending the International Conference, the group will enjoy a business-pleasure trip of priceless value.

This all-expense tour is offered at a cost of only $1000 per person (or $840 per person for those preferring to spend the fourth week on their own) and is open to members of the Society of Die Casting Engineers.

Arrangements can still be made by contacting Mr. Harry Cagin, Halex Die Casting Company, 8640 Bessemer Avenue, Cleveland 27, Ohio.

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NATIONAL DIE CASTING EXPOSITION AND CONGRESS

Your Society's 1960 Convention, which has been officially named the National Die Casting Exposition and Congress, is off to a fine start. Substantial progress is being made daily in completing arrangements for all the many activities that are part of such a Show. The Exposition and Technical Program, or Congress, will both be held at the Detroit Artillery Armory, 15000 West Eight Mile Road, Detroit, Michigan. The dates will be Tuesday, November 8, through Friday, November 11, 1960. By the time this magazine goes to press we will have in the mail to you an attractive brochure publicizing the event and soliciting orders for Exposition space.

John L. MacLaren

A. M. Clark

Harry D. Hall

David Salatin

"Mac" Nichols

Arthur Linzell

Ralph West

The make up of the team handling the various phases of the Show is as follows:

Chairman—John L. MacLaren, Aluminum Ltd. Sales, Inc.
Exposition Manager—A. M. Clark, Ford Motor Company.
Congress Manager—Harry D. Hall, General Motors Corp.
Congress Assistant Manager—David Salatin, General Motors Corp.
Publicity Manager—"Mac" Nichols, Manco Products Inc.
Registration Manager—Arthur Linzell, HPM-Cast Master Division, Koehring Corp.
House Manager—Ralph West, Aluminum Company of America.

These Committee Chairmen, whose photographs you see on this page, are all actively pursuing arrangements for the convention, and we know their efforts will reward us with a truly fine Show.

We want and need as much help as we can get from the Chapters. To expedite the clearance of ideas and information between Convention Headquarters and the Chapters, we have asked each Chapter to designate some one to act as coordinator as follows:

Detroit Chapter—Clarence Sulek, Rebmann Products Corp.
Western Michigan Chapter—C. M. Stewart, Holland Die Casting Co., Inc. and Herb Lloyd, E. F. Houghton Company.
Toledo Chapter—Rollie Fulton, Chevrolet Turboglide Division.
Chicago Chapter—Joe Schmidt, Lester-Phoenix Engineering Company.
Cleveland Chapter—Ollie Clayton, Efficient Tool and Die Company.
New York Chapter—Bill Vach, New Jersey Forms.
New England Chapter—Ernie Brix, Hampden Brass and Aluminum Company.
Syracuse Chapter—Herman Mamat, Roth Smelting Company.

We know your Convention Committee can count on your full support in making this an outstanding event. We will keep you fully advised of progress in future issues of the DIE CASTING ENGINEER and through your Chapter coordinators.

To aid us in bringing the Exposition to the attention of important executives in the die casting and supplier industries, please fill out the attached form and mail it to Society Headquarters.

CONVENTION HEADQUARTERS
SOCIETY OF DIE CASTING ENGINEERS, INC.
19382 JAMES COUZENS HWY.
DETROIT 35, MICHIGAN

Please send information on the 1960 National Die Casting Exposition and Congress to:

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— NEW BOOKS —

Metallurgy and Fuels, Vol. 2, Progress in Nuclear Energy Series V – H. M. FINNISTON and J. P. HOWE, Editors. 653 pages. Pergamon Press, Inc., 122 East 55th Street, New York 22, New York. 1959. $21.00.

The stated aim of the Metallurgy and Fuels Series, of which this volume is part, is to provide an up-to-date account of the science and technology of design, manufacture and performance of fuels, the metallurgy of reactor materials and an account of the progress made in solid state studies either by use of techniques specific to atomic energy or resulting from research in that field. The volume reviewed does just that.

Metallurgy and Fuels, Vol. 2, is a two part volume subdividing the material as nearly as possible into the classifications of technology and basic metallurgy. Part I, Basic Materials, deals with the extraction and purification of uranium, thorium, magnesium, plutonium, zirconium, beryllium, uranium oxide and thorium oxide and the design, fabrication and performance of reactor components made of these materials. Particular emphasis is placed on their use in the reactor core.

Part II, Solid State Physics and Basic Metallurgy, adds balance to the volume by presenting the new science behind recent technological achievements. A partial list of the topics discussed are: kinetics of transformation, preferred orientation, radiation effects, electronic structure of the heavy metals and alloy systems. These topics are specifically concerned with the basic materials of Part I.

In all, *Metallurgy and Fuels, Vol. 2,* provides well rounded coverage of the work done on the more "exotic" materials used in reactor construction up to the end of 1957. The volume is profusely illustrated with photographs, diagrams, charts and flow sheets, including quite a number of fold outs. – A. S.

Principles of Optics–MAX BORN and EMIL WOLF. 803 pages. Pergamon Press, Inc., 122 East 55th Street, New York 22, New York. 1959. $17.50.

Back in 1933 Max Born's *Optik* was published and, despite its influence, a much hoped for translation in English was deferred so long that its accomplishment now would fail to give a comprehensive and balanced view of the field. *Principles of Optics* is substantially different from its forerunner in plan and content however much inspired by it. Rigorously and tightly restricted to discussion of optical phenomena treatable in terms of Clerk Maxwell's phenomenological theory, the *Principles of Optics* deals with situations in which atomistic structure has no commanding role. It begins with the basic equations of Maxwell's electromagnetic theory to which practically all that follows in subsequent chapters is immediately traceable.

While the book is co-authored by Max Born and Emil Wolf, with the former presenting revised material from his *Optik* and giving much to general planning, and the latter compiling, writing and checking the text, other contributors are conspicuous in the new work: Prof. A. B. Bhattia contributed the chapter on the diffraction of light by ultrasonic waves; Dr. P. A. Wayman, the chapter on image-forming instruments; Dr. P. C. Clemmow, the chapter dealing with rigorous diffraction theory and an appendix on the mathematical methods of steepest descent and stationary phase; Prof. I. Gabor, an appendix showing the close formal analogy between geometrical optics, classical mechanics, and electron optics when these are presented in the language of the calculus of variations; Dr. W. L. Wilcock, the chapter on the elements of the theory of interference and interferometers; Prof. A. M. Taylor, the chapter on the optics of metals; Dr. A. R. Stokes, the chapter on the optics of crystals. – Robert Trochet.

NEW BOOKS

Zinc, the Science and Technology of the Metal, Its Alloys and Compounds – C. H. MATHEWSON, Editor. 721 pages. Reinhold Publishing Corp., 430 Park Avenue, New York 22, New York. 1959. $19.50.

Pseudogyras, that's the word the Greeks had for it, and it carried the implication that zinc was phony silver. Strabo, the geographer (Circa 63 B.C.), mentions it in a solitary passage. Archaeology affords information that man's practical acquaintance reaches deep into prehistory. In a fast-moving seven-page commentary, H. D. Carus, president of Matthiessen and Hegler Zinc Company, carries the reader from man's earliest concern with zinc to the contemporary production of zinc from the New Jersey Zinc's vertical retort process and the electrothermic process of St. Joseph Lead Company.

A half a hundred authors participate in this composite monograph, creating a grand-manner treatise on the metallurgy of zinc with grave attention to economic, statistical, scientific, technological and applicative aspects of the metal. It offers itself as the most complete book ever published on the subject, not boastfully, but just as a matter of fact. – Robert Trochet.

Received

Practical Design of Sheet Metal Stampings – FEDERICO STRASSER. 170 pages. Chilton Company, 56th and Chestnut Streets, Philadelphia 39, Pennsylvania. 1959. $10.00.

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CIRCLE 18 READERS SERVICE CARD

NEWS of the INDUSTRY

Alcoa introduces super-hard aluminum welding alloys

Aluminum castings and forgings, with precision-welded zones of super-hardness and high wear-resistance, were revealed by Alcoa Research Laboratories.

When applied to selected areas of commercial aluminum products, new aluminum welding alloys retain this hardness at very high temperatures. Thus, aluminum parts, with zones of the hard welding metal, are expected to find use in many automotive applications where localized hardness, wear and heat resistance are desired.

Piston ring grooves, brake drums, valve seats and sheaves are major prospects for the zoned weldments.

According to Alcoa research engineers, one of the new alloys (four are now being tested) provides a Brinell hardness of 250 at room temperature . . . as hard as heat-resistant high-alloy steel. Comparable commercial aluminum pistons generally exhibit 110 Brinell hardness.

At 500° F., the new welding alloys provide areas four times as hard as commercial aluminum piston compositions at the same temperature.

The photograph above is an aluminum diesel engine piston with welded zones of a super hard, wear-resistant alloy. Four of the new alloys were applied to the part in preparation for a ring groove test.

CIRCLE 19 READERS SERVICE CARD

Ingenious welding process for die repair

A new, fast and inexpensive method of repairing dies has been developed recently by Mid States Welder Manufacturing Company, Chicago, Illinois. The new process is called "Dot Welding," and it is described by Mid States officials as a fusion of metal pellets by a gun type welding device into the damaged die. The die need not be removed from the machine to make the repair. Fusion is produced by a short pulse of high density electrical current from the welder. This current raises the pellet temperature to the point of fusion and allows the pellet metal to flow into the cavity or scratch. The heat does not harm the die metal. In only a few minutes, the die may be filed or finish ground and polished to a point where it is almost impossible to detect the original imperfection.

CIRCLE 20 READERS SERVICE CARD

Award competition for light-weight zinc die casting designs

The New Jersey Zinc Company, producer of ZAMAK alloy for die casting and publisher of THE ALLOY POT, has announced a cash awards competition for the best examples of light-weight, thin-wall zinc die castings used in product design. The awards will be made, not to the die caster producing the part, but to the designer of the casting in the company which uses the die casting in its product.

The purpose of the contest is to stimulate interest in imaginative and progressive use of zinc die castings in the design or redesign of both industrial and consumer products. To qualify, entries must be of unusually light-weight construction. They will be judged on over-all efficient utilization of the advantages of the die casting process combined with the unique casting and mechanical properties of ZAMAK zinc alloys where the product or components might otherwise have been made either as stampings or castings of other metals.

The first award will be $200, the second $100 and the third, $50. Entry blanks and complete details may be obtained from "LIGHTER Than You Think" Contest Editor, The New Jersey Zinc Company, 160 Front Street, New York 38, New York. The contest closes January 31, 1960.

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INDUSTRY

Save time, save machines with inexpensive Kelm T-slot cleaner

A T-slot cleaner which cuts costly clean-up down-time and reduces damage to expensive machine tables was introduced by the Kelm Manufacturing Co., Coloma, Michigan. Made of 16 gauge chrome plated or black oxide steel, this versatile tool has one end for cleaning clogged T-slots, the other for spooning out the chips in the pockets at the end of the table. Price of the tool is $12.00 per doz. or $1.25 each.

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Die castings?
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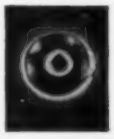

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CIRCLE 26 READERS SERVICE CARD

PEOPLE in DIE CASTING

■ The recent election of **R. C. Brock,** industrial division manager, to the post of vice-president of the industrial division of the Joseph Dixon Crucible Company, Jersey City, New Jersey, was announced by Frank G. Atkinson, president. Brock will supervise sales and marketing activities of Dixon's industrial division, which manufactures crucibles, refractories, industrial lubricants, protective paints and other products with graphite ingredients. He joined the Dixon organization in 1948 as a salesman in the industrial division.

■ **Russell Hanna,** of Cleveland Automatic Machine Company passed away suddenly on October 8, 1959. Mr. Hanna was an active member of the SDCE.

■ **Erwin H. Wokeck** has been appointed general manager of the Experimental Tool & Die Co., Inc., Detroit, Michigan.

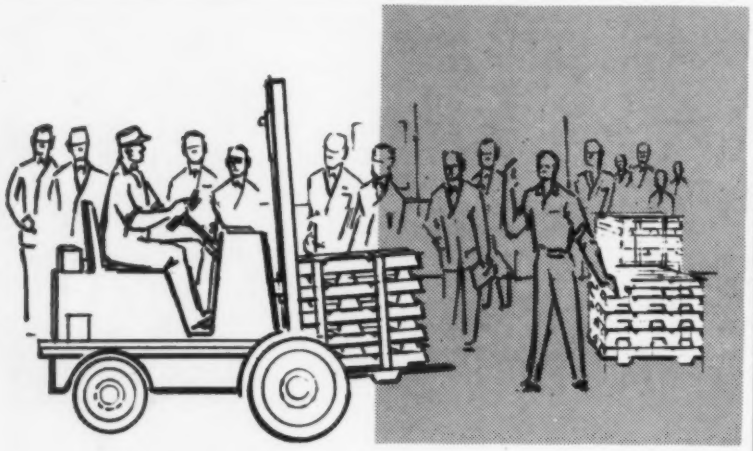
■ **William Gidley,** formerly with the Pontiac Varnish Co., recently became associated with the Clifford Rockwell Co., Detroit, Michigan, as a sales engineer.

John E. Grimshaw

■ **John E. Grimshaw** has been appointed Plant Superintendent for the Union Die Casting Company, Whittier, California, announces E. D. White, UDICO vice-president. Grimshaw was formerly associated with Phillips Manufacturing Co. as plant manager and chief engineer. Grimshaw will supervise production of UDICO's three divisions, Custom Die Casting, Consumer Products, and Plumbing and Hardware.

Geoffrey Paget

■ The appointment of **Geoffrey Paget** as chief metallurgist for the Shaw Process Development Corp., Port Washington, New York, was announced recently. Paget, a veteran of twenty years in the field of metallurgy, is as well known in Britain and Canada as he is in this country. He is an Associate of the Institute of Metallurgy and a member of the American Society for Metals and the Institute of British Foundrymen.



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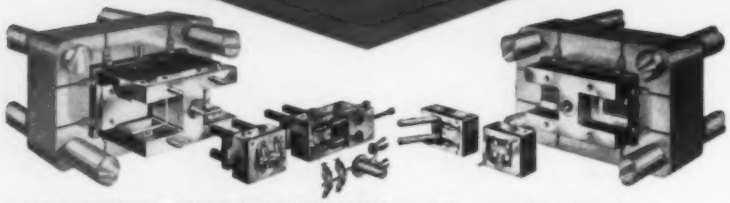

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Closing date: 15th of month preceding publication.

To answer Box number advertisements, address responses to: Box ——, Die Casting Engineer, 19382 James Couzens Highway, Detroit 35, Michigan.

WELL ESTABLISHED FIRM seeking well qualified man capable of taking charge of die cast aluminum foundry. Must be completely familiar with die shop operations. Ability to design and supervise construction of dies, trim dies and fixtures is very important. Foundry located approximately 100 miles north of Chicago. State background, qualifications and salary desired. Write Box 114.

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